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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

TDP3471 – DISTRIBUTED AND PARALLEL COMPUTING (All sections / Groups)

10th MARCH 2017
3:00 p.m – 5:00 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

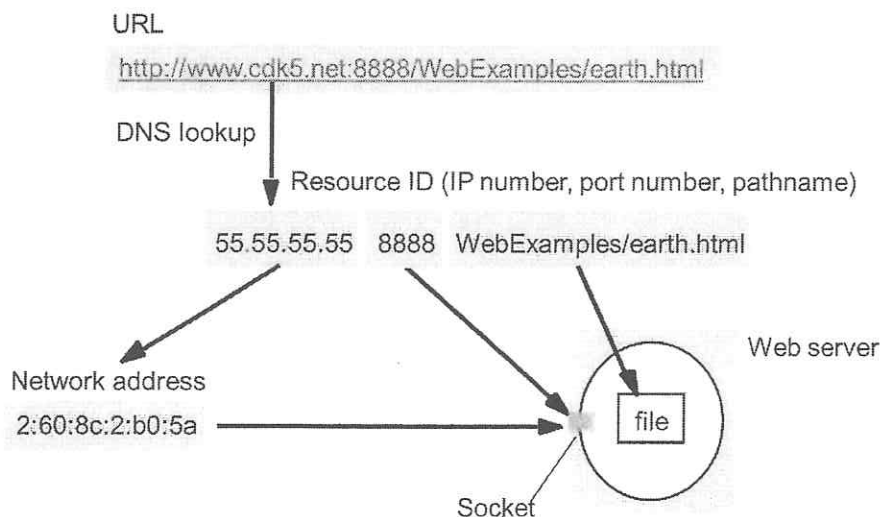
1. This question paper consists of 4 pages, including this page, with 5 questions.
2. Attempt **FOUR** out of **FIVE** questions. The distribution of the marks for each question is given. This paper carries **40 marks**.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (10 marks)

- a) What is the main motivation for Distributed Systems? [1 mark]
- b) One of the major challenges of a Distributed System is to achieve transparency. State at least 5 different types of transparency and provide a brief description for each. [5 marks]
- c) Based on your understanding, describe the function of a network socket. Briefly explain the differences between UDP Datagram Communication and TCP Stream Communication. [4 marks]

Question 2 (10 marks)

- a) What is meant by "A distributed system has no notion of a global clock?" [2 marks]
- b) Briefly explain the similarities between RMI and RPC. [2 marks]
- c) Using the Unified Resource Locator (URL) example below, explain the various steps needed to communicate with the resource. [4 marks]



[4 marks]

Continued ...

- d) In the concept of Exchange Protocols, there are 3 methods as tabled below. Using the RRA method, the server has the option to remove the entries from its history. Briefly explain why the server should keep the entries in its history for the other two methods, R and RR?

Name	Messages sent by		
	Client	Server	Client
R	Request		
RR	Request	Reply	
RRA	Request	Reply	Acknowledge reply

[2 marks]

Question 3 (10 marks)

- a) Briefly discuss at least two (2) differences between the Clustered Computing and Distributed Processing.

[2 marks]

- b) Suppose that MPI COMM WORLD consists of the three processes 0,1, and 2, and the following code is executed:

```
int x, y, z;
switch(my_rank) {
    case 0:
        x=0; y=1; z=2;
        MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Send(&y, 1, MPI_INT, 2, 43, MPI_COMM_WORLD);
        MPI_Bcast(&z, 1, MPI_INT, 1, MPI_COMM_WORLD);
        break;
    case 1:
        x=3; y=8; z=5;
        MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
        break;
    case 2:
        x=6; y=7; z=8;
        MPI_Bcast(&z, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Recv(&x, 1, MPI_INT, 0, 43, MPI_COMM_WORLD, &status);
        MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
        break;
}
```

Synopses of the MPI functions are as given below (for reference on the parameters):

```
int MPI_Bcast( void *buffer, int count, MPI_Datatype datatype,
               int root, MPI_Comm comm )

int MPI_Send(const void *buf, int count, MPI_Datatype datatype,
             int dest, int tag, MPI_Comm comm)

int MPI_Recv(void *buf, int count, MPI_Datatype datatype, int source,
             int tag, MPI_Comm comm, MPI_Status *status)
```

What are the values of x, y, and z on each process after the code has been executed?

[6 marks]

Continued ...

- c) Explain the differences between blocking and non-blocking message passing.
[2 marks]

Question 4 (10 marks)

- a) What are the basic commands to create and destroy a thread?
[2 marks]
- b) Assuming that you have a program called `hello.c` which uses the `pthread` library and you want to compile it into an executable called `hello`, what is the command used in Linux?
[2 marks]
- c) State and briefly explain at least 3 advantages of threading.
[3 marks]
- d) A critical section requires a mechanism for ensuring that only one process accesses a particular resource at a time. Explain one such mechanism to achieve this when two or more processes are attempting to access the same shared resource.
[3 marks]

Question 5 (10 marks)

- a) What is superlinear speedup?
[1 mark]
- b) Suppose that 5% of a program's code cannot be parallelized at all and the remaining 95% can be perfectly parallelized:
- If we use 100 processors to run this program in parallel, what would be the maximum speedup that can be obtained according to Amdahl's law?
 - Calculate the efficiency for the case in (i).
 - What is the scaled speedup factor according to Gustafson's law?
 - What is the efficiency for the case in (iii)?
- [4 marks]
- c) Deadlocks can occur with two processes when one requires a resource held by the other, and this process requires a resource held by the first process. Using a diagram, explain what is a circular deadlock?
[2 marks]
- d) Bernstein's conditions are a set of conditions that are sufficient to determine whether two processes can be executed simultaneously (deadlock free). We define two sets of memory locations:
- I_i is the set of memory locations read by process P_i .
 - O_j is the set of memory locations altered by process P_j .
- Using these set of memory locations I_i and O_j , state the 3 Bernstein's conditions.
[3 marks]

END OF EXAM PAPER